arch BQ be drawn and produced to S, so that QS be equal to RQ, and consequently RS be equal to the chord of the arch BF; and let FS be drawn and produced to T in the side BC. I say, the Straight Line BT is equal to the Arch BF; and consequently that BV the triple of BT is equal to the Arch of the Quadrant $BFED$.[22]

Let TF be produced till it meet the side BA produced in X; and dividing OF in the middle in Z, let QZ be drawn and produced till it meet with the side BA produced. Seeing therefore the Straight Lines RS and OF are parallel and divided in the midst in Q and Z, QZ produced will fall upon X, and XZQ produced to the side BC will cut BT in the midst in a.

Upon the Straight line FZ the fourth part of the Radius AB let the equilateral triangle aZF be constructed; & upon the center a, with the Radius aZ let the arch ZF be drawn, which arch ZF will therefore be equal to the arch QF the half of the arch BF.[23] Again, let the straight line ZO be cut in the midst in b, and the straight line bO in the midst in c; and let the bisection be committed in this manner till the last part Oc be the least that can possibly be taken; and upon it, and all the rest of the parts equal to it into which the straight line OF may be cut, let so many equilateral triangles be understood to be constructed; of which let the last be dOc. If therefore upon the center d, with radius dO be drawn the arch Oc, and upon the rest of the equal parts of the straight line OF be drawn in like manner so many equal arches, all of those arches together taken will be equal to the whole arch BF; & the half of them, namely, those that are comprehended between O & Z, or between Z & F will be equal to the arch BQ or QF and in summe, what part soever the straight line Oc be of the straight line OF, the same part will the arch Oc be of the arch BF, though both the arch and the chord be infinitely bisected. Now seeing the arch Oc is more crooked then that part of the arch BF which is equal to it; and seeing also that the more the straight line Xc is produced the more it diverges from the straight line XO, if the points O and c be understood to be moved forwards with straight motion in XO and Xc, the arch Oc will thereby be extended by a little and little, till at the last it come some where to have the same crookedness with that part of the arch BF which is equal to it. In like manner, if the straight line Xb be drawn, and that point b be understood to be moved forwards at the same time, the arch cb will also by little and little be extended, till its crookedness come to be equal to the crookedness of that part of the arch BF which is equal to it. And the same will happen in all those small equal arches which are described upon so many equal parts of the straight line OF.

22. This construction is the same as the previous attempted quadrature, although the labels are different. The same trigonometric calculation set forth in note 16 suffices to refute the claim.

23. Indeed, the arcs both have the value $\pi/12$, taking AD as unit.

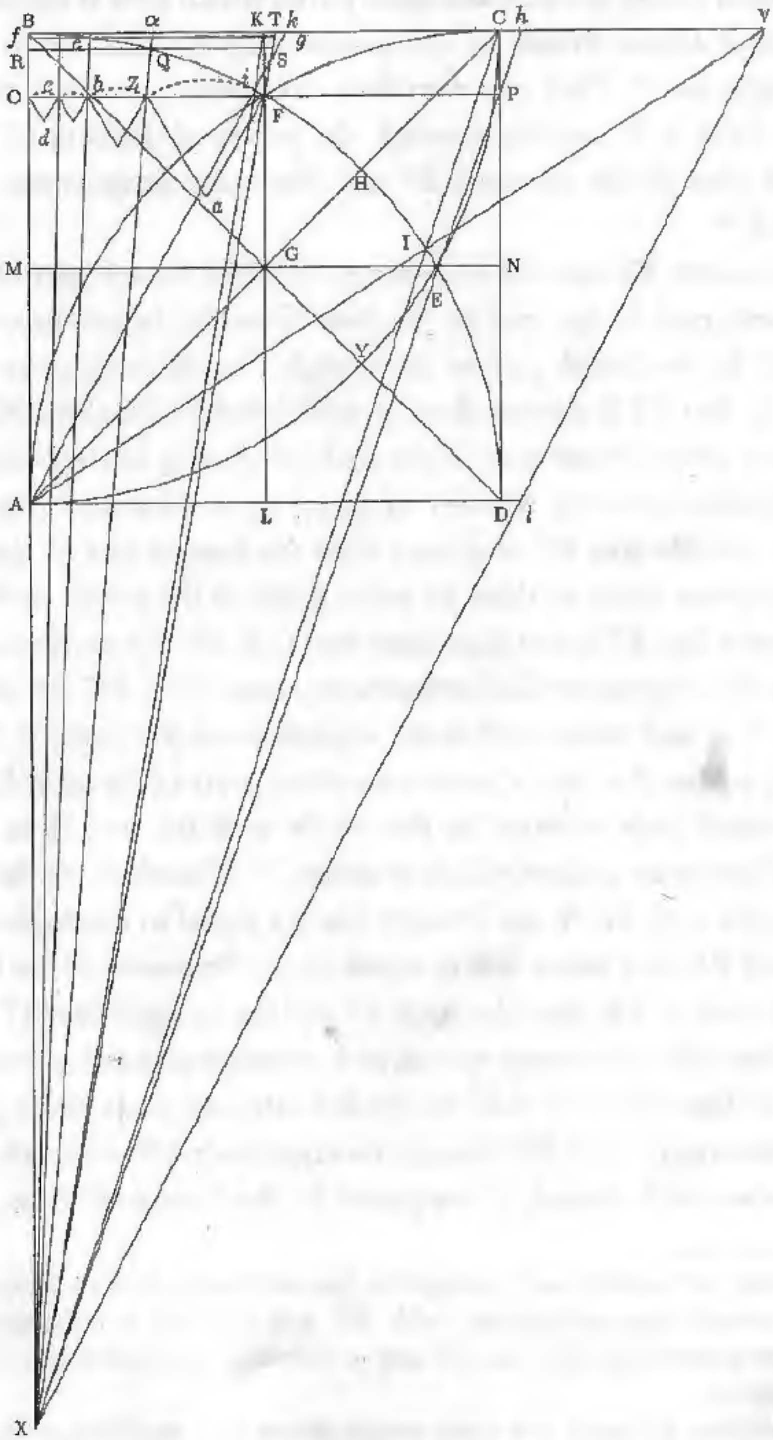

Figure A.3.2

It is also manifest, that by straight motion in *XO* and *XZ* all those small arches will lie in the arch *BF* in the points *B*, *Q* and *F*.[24] And though the same small equall arches should not be coincident with the equall parts of the arch *BF* in all other points thereof, yet certainly they will constitute two crooked lines, not onely equall to the two arches *BQ* and *QF* and equally crooked; but also

24. What Hobbes claims to be "manifest" here is essentially the same falsehood that destroyed the quadrature in A.3.1. Although the rectilinear motion Hobbes de-

having their cavity towards the same parts; which how it should be, unlesse all those small arches should be coincident with the arch *BF* in all its points, is not imaginable.[25] They are therefore coincident, and all the straight lines drawne from *X* & passing through the points of division of the straight line *OF*, will also divide the arch *BF* into the same proportions into which *OF* is divided.[26]

Now seeing *Xb* cuts off from the point *B* the fourth part of the arch *BF*, let that fourth part be *Be;* and let the Sine thereof *fe* be produced to *FT* in *g*, for so *fe* will be the fourth part of the straight line *fg*, because as *Ob* is to *OF*, so is *fe* to *fg*. But *BT* is greater then *fg;* and therefore the same *BT* is greater then four Sines of the fourth part of the arch *BF*. And in like manner, if the arch *BF* be subdivided into any number of equal parts whatsoever, it may be proved that the straight line *BT* is greater then the Sine of one of those small arches so many times taken as there be parts made of the whole arch *BF*. Wherefore the Straight line *BT* is not lesse then the Arch *BF*. But neither can it be greater, because if any straight line whatsoever, lesse then *BT*, be drawn below *BT* parallel to it and terminated in the straight lines *XB* and *XT*, it would cut the arch *BF;* and so the Sine of some one of the parts of the arch *BF* taken so often as that small arch is found in the whole arch *BF*, would be greater then so many of the same arches; which is absurd.[27] Wherefore the Straight line *BT* is equal to the arch *BF*, & the Straight line *BV* equal to the Arch of the Quadrant *BFD;* and *BV* four times taken, equal to the Perimeter of the Circle described with the Radius *AB*. Also the Arch *BF* and the Straight line *BT* are every where divided into the same proportions; and consequently any given Angle, whether greater or less then *BAF* may be divided into any proportion given.

But the straight line *BV* (though its magnitude fall within the terms assigned by *Archimedes*) is found, if computed by the Canon of Sines, to be somwhat

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scribes here will undoubtedly straighten the small arcs, he has no guarantee that they will be brought into coincidence with $\widehat{BF}$, and this fact is independent of his rather jarring assumption that the line *OF* can be infinitely subdivided and an infinity of small arcs produced.

25. Hobbes evidently felt some unease about the soundness of this argumentation, but he could not give up the idea that he had found the way to rectify $\widehat{BF}$. His assertion that the two "crooked lines" are equal to $\widehat{BQ}$ and $\widehat{QF}$ is, however, in error and begs the very question at issue.

26. As with the previous attempt at quadrature, the demonstration could have ended here, since this result would be equivalent to the quadrature of the circle. Hobbes nevertheless continues with the same kind of flawed attempt at double reductio ad absurdum he had earlier undertaken.

27. The "absurdity" arises from the fact that Hobbes in effect assumes that his construction divides the arc into equal parts, which is exactly the result he needed to prove. In fact, *BT* will exceed the arc $\widehat{BF}$.

greater then that w^ch is exhibited by the *Ludolphine* numbers.[28] Nevertheless, if in the place of *BT*, another straight line, though never so little less, be substituted, the division of Angles is immediately lost, as may by any man be demonstrated by this very Scheme.[29]

Howsoever, if any man think this my Straight line *BV* to be too great, yet, seeing the Arch and all the Parallels are every where so exactly divided, and *BV* comes so neer to the truth, I desire he would search out the reason, Why (granting *BV* to be precisely true) the Arches cut off should not be equal.

But some man may yet ask the reason why the straight lines drawn from *X* through the equal parts of the arch *BF* should cut off in the Tangent *BV* so many straight lines equal to them, seeing the connected straight line *XV* passes not through the point *D*, but cuts the straight line *AD* produced in *l*; and consequently require some determination of this Probleme,[30] Concerning which, I will say what I think to be the reason, namely, that whilest the magnitude of the Arch doth not exceed the magnitude of the Radius, that is, the magnitude of the Tangent *BC*, both the Arch and the Tangent are cut alike by the straight lines drawn from *X*; otherwise not. For *AV* being connected, cutting the arch *BHD* in *I*, if *XC* being drawn should cut the same arch in the same point *I*, it would be as true that the Arch *BI* is equal to the Radius *BC*, as it is true that the Arch *BF* is equal to the straight line *BT*, and drawing *XK* it would cut the arch *BI* in the midst in *i*; Also drawing *Ai* and producing it to the Tangent *BC* in *k*, the straight line *Bk* will be the Tangent of the Arch *Bi*, (which arch is equal to half the Radius) and the same straight line *Bk* will be equal to the straight line *kI*. I say all this is true, if the preceding demonstration be true; and consequently the proportional section of the Arch and its Tangent proceeds hitherto. But it is manifest by the Golden Rule,[31] that taking *Bh* dou-

28. Ludolph van Ceulen (1539–1610) calculated π to thirty-five decimal places while Archimedes found the inequalities $3.14084 < \pi < 3.142858$. Hobbes's construction makes π approximately 3.1419234.

29. Again, Hobbes seems unable to resist begging the question. He assumes that he has found the means to divide any angle into any given number of equal parts, and that this result is "lost" if his construction should fail. But the division is correct only if he has already squared the circle.

30. This is presumably the kind of argument used by one of Hobbes's friends to persuade him of the inadequacy of his quadrature. If the construction had been successful, the line *XD* produced should intersect *BC* produced at *V*, but it does not.

31. The "Golden Rule" or "Rule of Three" is the elementary principle that allows the fourth term of a proportion to be computed if the first three terms are given. As Wallis states it in *Mathesis Universalis:* "Let the third be multiplied by the second, and the product be divided by the first. The quotient will exhibit the fourth term sought" (*MU* 38; *OM* 1:196). Hobbes's point here is that elementary trigonometric calculation shows that his construction fails to solve the problem posed.

ble to *BT*, the line *Xb* shall not cut off the arch *BE* which is double to the arch *BF*, but a much greater. For the magnitude of the straight lines *XM*, *XB* and *ME* being known (in numbers) the magnitude of the straight line cut off in the Tangent by the straight line *XE* produced to the Tangent may also be known; and it will be found to be less then *Bb;* wherefore the straight line *Xb* being drawn will cut off a part of the arch of the Quadrant greater then the arch *BE*. But I shall speak more fully in the next Article concerning the magnitude of the arch *BI*.

And let this be the first attempt for the finding out of the dimension of a Circle by the Section of the arch *BF*.

A.4 THE COMPARISON OF THE SPIRAL OF ARCHIMEDES WITH THE PARABOLA

This result is one of the more intriguing pieces of mathematics to make its way into *De Corpore*. It is Hobbes's account of the rectification of the Archimedean spiral in part 3, chapter 20, article 5. As I argued in chapter 3, the reasoning Hobbes employs here is closely connected with Roberval's analysis of the same problem, as well as making use of Galileo's analysis of the construction of the parabola from uniformly accelerated motion. The argument is essentially sound, the only flaw being Hobbes's assumption that he has rectified arc of the quadrant (in the preceding sections) and that he had found the means to rectify the parabola in the eighteenth chapter of *De Corpore*. This led Hobbes to declare that

> From the known Length of the Arch of a Quadrant, and from the proportional Division of the Arch and of the Tangent *BC*, may be deduced the Section of an Angle into any given proportion; as also the Squaring of the Circle, the Squaring of a given Sector, and many the like propositions, which it is not necessary here to demonstrate. I will therefore onely exhibit a Straight line equal to the Spiral of Archimedes, and so dismiss this speculation. (*DCo* 3.20.4; *EW* 1:307)

The argument remained unaltered between its first appearance in the 1655 and 1656 versions of *De Corpore*, but it was removed from the 1668 version. I present the English translation of 1656.

The length of the Perimeter of a Circle being found, that Straight line is also found, which touches a Spiral at the end of its first conversion. For upon the center *A* [in figure A.4] let the circle *BCDE* be described; and in it let *Archimedes* his Spiral *AFGHB* be drawn, beginning at *A* and ending at *B*. Through the center *A* let the straight line *CE* be drawn, cutting the Diameter *BD* at

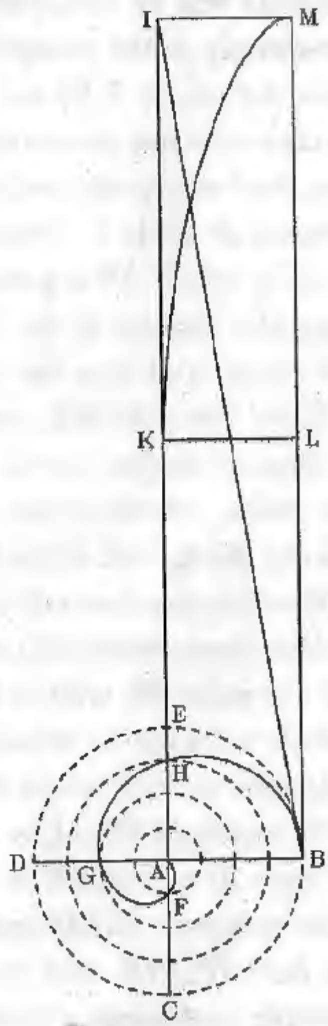

Figure A.4

right angles; and let it be produced to *I*; so, that *AI* be equal to the Perimeter *BCDEB*. Therefore *IB* being drawn will touch the Spiral *AFGHB* in *B*; which is demonstrated by *Archimedes* in his book *de Spiralibus*.[32]

And for a Straight Line equal to the given Spiral *AFGHB*, it may be found thus.

Let the straight line *AI* (which is equal to the Perimeter *BCDE*) be bisected in *K*; and taking *KL* equal to the Radius *AB*, let the rectangle *IL* be completed. Let *ML* be understood to be the axis, and *KL* the base of a Parabola, and let *MK* be the crooked line thereof. Now if the point *M* be conceived to be so moved by the concourse of two movements, the one from *IM* to *KL* with velocity encreasing continually in the same proportion with the Times, the other from *ML* to *IK* uniformly, that both those motions begin together in *M* and end in *K*; *Galilaeus* has demonstrated that by such motion of the point *M*, the

32. The relevant results are propositions 18–20 of Archimedes' "On Spirals." See Archimedes 1919, 171–76, and Dijksterhuis [1956] 1987, 268–74.

crooked line of a Parabola will be described.[33] Again, if the point *A* be conceived to be moved uniformly in the straight line *AB*, and in the same time to be carried round upon the center *A* by the circular motion of all the points between *A* and *B*, *Archimedes* has demonstrated that by such motion will be described a Spiral line. And seeing the circles of all these motions are concentrick in *A;* and the interiour circle is alwayes lesse then the exteriour in the proportion of the times in which *AB* is passed over with uniform motion; the velocity also of the circular motion of the point *A*, will continually encrease proportionally to the times. And thus far the generations of the Parabolical line *MK*, and of the Spiral line *AFGHB*, are like. But the Uniform motion in *AB* concurring with circular motion in the Perimeters of all the concentrick circles, describes that circle, whose center is *A*, and Perimeter *BCDE;* and therefore that circle is (by the *Coroll.* of the first article of the 16 Chapter) the aggregate of all the Velocities together taken of the point *A* whilst it describes the Spiral *AFGHB*.[34] Also the rectangle *IKLM* is the aggregate of all the Velocities together taken of the point *M*, whilest it describes the crooked line *MK*. And therefore the whole velocity, by which the Parabolicall line *MK* is described, is to the whole velocity with which the Spiral line *AFGHB* is described in the same time, as the rectangle *IKLM*, is to the Circle *BCDE*, that is to the triangle *AIB*. But because *AI* is bisected in *K* & the straight lines *IM* & *AB* are equal, therefore the rectangle *IKLM* and the triangle *AIB* are also equal. Wherefore the Spiral line *AFGHB*, and the Parabolical line *MK*, being described with equal velocity and in equal times, are equal to one another. Now

33. This is the familiar result from the "fourth day" of Galileo's "Two New Sciences" (Galileo 1974, 221).

34. The corollary in question is Hobbes's version of the "mean speed theorem" and asserts that "[i]f the *Impetus* be the same in every point, any straight line representing it may be taken for the measure of Time; and the Quicknesses or *Impetus* applied ordinately to any straight line making and Angle with it, and representing the way of the Bodies motion, will designe a parallelogram which shall represent the velocity of the whole Motion. But if the *Impetus* or Quickness of Motion begin from Rest, and increase Uniformly, that is, in the same proportion continually with the times which are passed, the whole Velocity of the Motion shall be represented by a Triangle, one side whereof is the whole time, and the other the greatest *Impetus* acquired in that time; or else by a parallelogram, one of whose sides is the whole time of Motion, and the other, half the greatest *Impetus;* or lastly by a parallelogram having for one side a mean proportional between the whole time & half of that time, & for the other side the half of the greatest *Impetus*. For both these parallelograms are equal to one another, & severally equal to the triangle which is made of the whole line of time, and the greatest acquired *Impetus;* as is demonstrated in the Elements of Geometry" (*DCo* 3.16.1, corollary 2; *EW* 1:219). Hobbes's use of it here is to argue that the increasing velocity of the point describing the spiral can be analyzed as a right triangle, having one side equal to the radius of the circle and the other equal to the circumference. Such a triangle has an area equal to that of the circle.

in the first article of the 18 Chapter a straight line is found out equal to any Parabolical line. Wherefore also a Straight line is found out, equal to a given Spiral line of the first revolution described by *Archimedes;* which was to be done.

A.5 HOBBES'S 1661 CUBE DUPLICATION

This is the original version of Hobbes's efforts to duplicate the cube, which stand at the center of his unsuccessful campaign for membership in the Royal Society in 1661–62. It was written in French and published anonymously in Paris in 1661. Subsequent versions of the same basic construction were published in Hobbes's *Dialogus Physicus* (1661) and *Problemata Physica* (1662). In addition, Hobbes circulated several other variations of the argument among fellows of the Royal Society in 1662, and Charles II requested that the society deliver its verdict on the validity of Hobbes's argumentation in the same year. The most striking feature of this particular version of the argument is the clutter of extraneous lines in the construction. The inadequacy of the construction can be shown quite easily: after the stipulation that the line *AS* is to be taken equal to the semidiagonal *BI*, this fact is never appealed to in the further course of the argument, which means that the proof would proceed just as correctly if *AS* had been of any length whatever.[35]

The Duplication of the Cube
By V.A.Q.R.

A RIGHT LINE BEING GIVEN, to find two mean proportionals between it and its half.

Let the right line *AB* [in figure A.5] be given, whose square is *ABCD,* and let this be divided into four equal squares by the right lines *EF, GH,* which intersect in the center of the square *ABCD,* at point *I.* In this way, the four sides will be divided in two equal parts at the four points *E, F, G, H.* Thus, it is required to find two mean proportionals between *DC* and *DF.*

I draw the diagonals *AC, BD,* and describe the four circle quadrants *ABD, BCA, CDB, DAC,* whose arcs cut the said diagonals at *K, L, M, N.* At these points the arcs are each divided into two equal parts, as is well known.

I produce *BA, CD* to the points *O* and *P,* so that *AB* is equal to *AO* and *DP* is equal to *DC.* And having described the circle quadrant *ADO* and drawn the diagonal *AP* (which will cut the arc *DO* into two equal parts at point *Q*),

35. This is essentially Huygens's argument as relayed to the Royal Society in his evaluation of Hobbes's duplication (*CTH* 2:538–39).

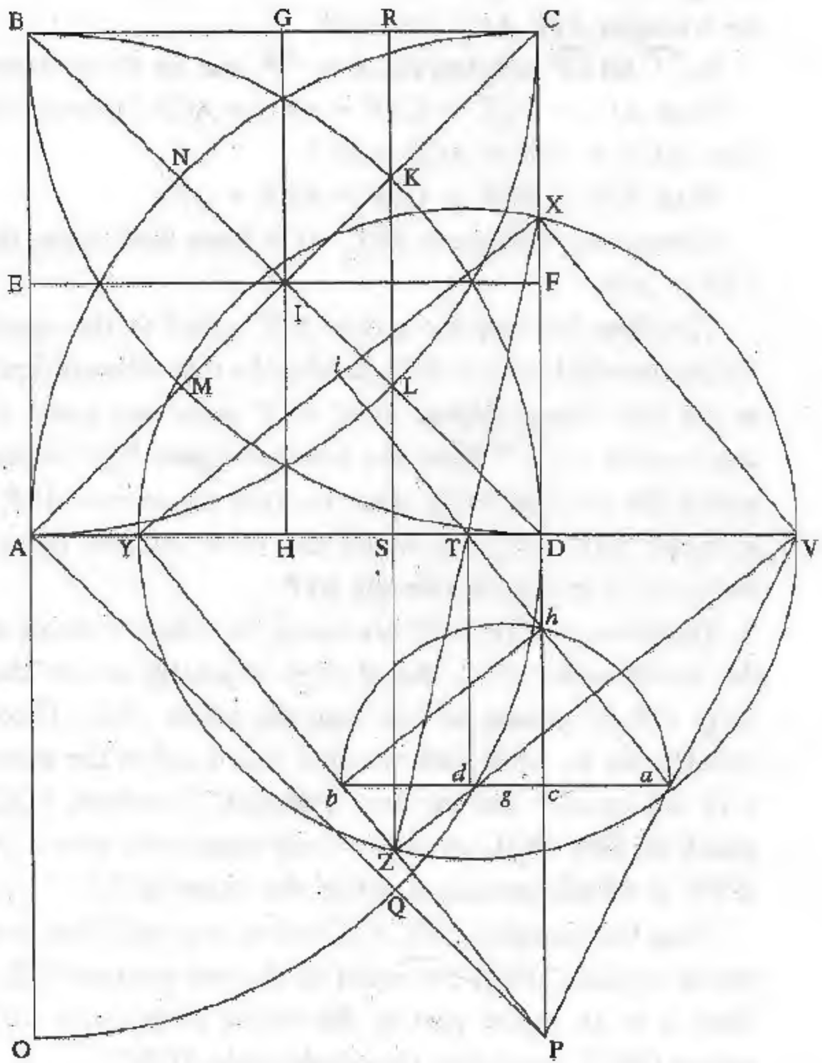

Figure A.5

I further take *R* in *BC* so that *BR* will be equal to the sine of 45 degrees, that is to say to the semidiagonal *BI*.[36] Consequently, *SD* is the excess of the side *AD* over the semidiagonal *AS*.

I cut this *SD* in two equal parts at *T*. In *AD* produced I take *DV* equal to *DF*, and making *T* the center and *TV* the semidiameter, I describe the circle *VXYZ*, cutting *DC* at *X*, *DA* at *Y*, and the right line *RS* produced at *Z*. And I say that the two right lines *DY*, *DX* are the two mean proportionals demanded between *DP* (equal to *AB*) and *DV* (equal to its half, *DF*).

For, drawing the right lines *VX*, *XY*, the angle *VXY* (in the semicircle) will be a right angle. And the right line *XT*, being drawn and produced to the con-

36. The original French reads, "Et ayant décrit le quart de cercle ADO, & tiré la diagonale AP (qui coupera l'arc DO en deux parties égales, au point Q.) Et étant produite de l'autre part en R, marquera BR égale au sinus droit de 45 degrés, c'est à dire à la semidiagonale BI."

cavity of the circle *VXYZ* will fall on *Z*, because *ST*, *TD* are equal. Consequently, *SZ* will be equal to *DX*, and *XZ* will be a diameter of the circle *VXYZ*. Therefore, the angle *XYZ* in the semicircle will be a right angle, and in drawing the right lines *YZ*, *VZ* we make the rectangle *VXYZ*, whose sides *VX*, *YZ* are parallel.[37]

Now, if the right line *YZ* produced falls on *P*, the whole line *PZY* will be right and parallel to *VX*, and the alternate angles *YPX*, *VXP* will be equal. The angles *YPX* and *XYD* will also be equal, and the three right triangles *PDY*, *YDX*, and *XDV* will be similar. Consequently, the four right lines *PD*, *DY*, *DX*, *DV* will be in the same continued ratio.

It is therefore required to demonstrate that the right line *YZ* produced falls on *P*.

Let *PV* be drawn and divided in two equal parts at *a*. Let the right line *ab* also be drawn parallel to *AV* and cutting *PD* at *c*. Further, let *Td* be drawn parallel to *PD*, cutting *ab* at *d*, and let *dc* be divided in two equal parts at *g*. On the center *g* with distance *ga* let the semicircle *ahb* be described, cutting *PD* at *h* and *ab* at *b*.

This being done, the two right lines *ah*, *bh* being drawn will form a right angle at *h*. Now *ac* is half of *DV*, and because *dg*, *gc* are equal, *db* will also be equal to half of *DV*, and *ab* will be half of *YV*.

Therefore, as *PD* is to *DY*, that is to say to the line composed of *DS* and *SY*, so also is *Pc* (the half of *PD*) to *cb*, the line composed of the halves of *DS* and *SY*, and consequently *Pb* being produced will fall on *Y*. And the right lines *hb*, *ha* will be the halves of the right lines *XY*, *XV*; and *XY* being divided in two equal parts at *i*, the figure *Yihb* will be a rectangle, and *Yb* will be parallel to *XV*.[38] But *YZ* is parallel to *XV*. Therefore, *YZ* produced will fall on *P*. And (because of what was demonstrated) the four right lines *PD*, *DY*, *DX*, *DV* are in one and the same continued ratio. I have therefore found two mean proportionals between a given right line and its half. Which was required to be done.

Consectary. A cube that has the lesser of these two means as an edge is double of a cube that has the half of the greater extreme for an edge.[39] Because the ratio of a cube to a cube is triplicate of the ratio of the edge to an edge. And the ratio of *PD* to *DX* is triplicate of the ratio of *PD* to *DY*.

37. Reading "tirant les doites YZ, VZ" for "tirant la doite YZ."

38. This consequence fails to follow. The prior argumentation establishes that *Yihb* is a parallelogram, but not that it is a rectangle. From this point forward, the demonstration proceeds from a false assumption to a false result.

39. Reading, "Vn Cube qui a pour côté la moindre de ces deux moyennes" for "Vn Cube qui a pour côté la plus grande de ces deux moyennes," which misstates the intended result.

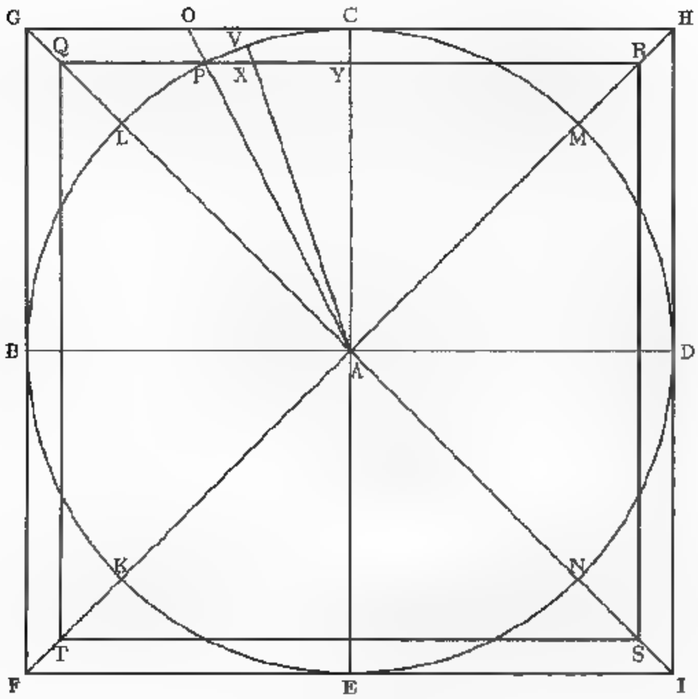

Figure A.6

A.6 THE 1669 *QUADRATURA*

This Hobbesian quadrature is a vastly different kind of argument from what we saw in *De Corpore*. This argument makes no appeal to the "method of motions," which Hobbes seems by this time to have largely abandoned, nor does it attempt to determine the area of the circle by considering indivisible "least elements" of lines or surfaces. Instead, Hobbes relies upon a very simple geometric construction and a short (but ultimately fallacious) argument about the relationship between the areas of finite parts of circle sectors. More surprisingly, the theorem implies a value of 3.2 for π, which is quite significantly further off the mark than Hobbes's earlier efforts.

Proposition I: To Find a Circle Equal to a Given Square

Let the given circle be *BCDE* [in figure A.6], whose center is *A*, and let it be divided into four parts by the diameters *BD*, *CE*. Let the square *FGHI* be circumscribed about this circle, which touches the circle at points *B*, *C*, *D*, *E*. Let the diagonals *GI*, *HF* be drawn, cutting the circle at the points *K*, *L*, *M*, *N*. Let the half-side *CG* be bisected at *O*, and let *AO* be drawn cutting the circle at *P*. Through the point *P* let the right line *QR* be drawn parallel to *GH*, cutting *AG*, *AH* at *Q* and *R*, and *AC* at *Y*. And let the square *QRST* be completed. I say that the square *QRST* is equal to the given circle *BCDE*.

Because the right line *CG* is bisected at *O*, and the bases *CG*, *YQ* of the

triangles *ACG*, *AYQ* are parallel, the base *YQ* is also bisected at *P*, and thus the triangles *AYP*, *APQ* are equal.

In $\widehat{LC}$ let $\widehat{LV}$ be taken equal to $\widehat{CP}$, and let *AV* be drawn, cutting *YP* at *X*.

Now $APL + PQL + CYP = AVL = ACP$ (because $APL + PQL = AYP$). Also, $ACV + AVP = ACP = AVL$.

Thus $APL + PQL + CYP = ACV + AVP$.

Subtracting the equals *APL*, *ACV* from both sides, there remains $PQL + CYP = AVP$.

Therefore because the sector *AVP* added to the equal sectors *ACV*, *ALP* makes the whole sector *ACL*, so also the two trilinear figures *PQL*, *CYP* added to the same equal sectors *ACV*, *ALP* make two equal triangles equal to the same sector *ACL*.[40] Now the trilinear figure *PQL* added to the sector *ALP* makes the triangle *APQ*. And (because the sectors *ALP*, *ACV* are equal and triangles *AYP*, *APQ* are equal) the same trilinear figure *PQL* added to the sector *ACV* makes the triangle *AYP*.

Therefore if *PQL*, *CYP* are equal, the whole triangle *AYQ* will be equal to the whole sector *ACL*. But if *PQL* is greater or less than *CYP*, the triangle *AYQ* will be greater or less than the sector *ACL*. Therefore either no right triangle can be taken with vertex *A* and equal to the sector *ACL*, or *PQL* and *CYP* are equal.[41] But the first is absurd. Therefore, *PQL*, *CYP* are equal, of which the first *(PQL)* extends wholly outside the sector *ACL*, while the second *(CYP)* is wholly contained within the sector *ACL*.

Thus the triangles *AYP*, *APQ* taken together (that is an eighth part of the whole square *QRST*) are equal to the two sectors *ACP*, *APL* taken together (that is to an eighth part of the whole given circle *BCDE*), and the whole square *QRST* is equal to the whole circle *BCDE*.

Therefore a square has been found equal to a given circle.[42]

40. As Wallis observes (1669a, 2), this misstates the case slightly since "these will not *make two triangles* (even though they can be equal to two triangles)."

41. Sadly for Hobbes, both disjuncts of this claim are false.

42. Elementary calculation reduces this conclusion to absurdity. Since $AO:AP :: AC:AY :: OC:PY$, it follows that $AO^2:AP^2 :: ACO:AYP$ (since similar figures with proportional sides are in duplicate ratio). Then, setting the radius *AP* or *AC* equal to *R*, we get $CO = R/2$, and $AP^2 = R^2$. Further, $AO^2 = R^2 + R^2/4 = 5R^2/4$ and (substituting and simplifying the proportion $AO^2:AP^2 :: ACO:AYP$) we obtain $ACO = R^2/4$. Thus, $AYP = R^2/5$ and $AYQ = 2R^2/5$. In consequence *QRST* will be $16R^2/5$, which results in a value of 3.2 for π.

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PHILOSOPHY / SCIENCE

In 1655, the philosopher Thomas Hobbes claimed he had solved the centuries-old problem of "squaring the circle"—constructing a square equal in area to a given circle. With a scathing rebuttal to Hobbes's claims, the mathematician John Wallis began one of the longest and most intense intellectual disputes of all time. *Squaring the Circle* is a detailed account of this controversy, from the core mathematics to the broader philosophical, political, and religious issues at stake.

Hobbes believed that by recasting geometry in a materialist mold, he could solve any problem in geometry and thereby demonstrate the power of his materialist metaphysics. Wallis, a prominent Presbyterian divine as well as an eminent mathematician, refuted Hobbes's geometry as a means of discrediting his philosophy, which Wallis saw as a dangerous mix of atheism and pernicious political theory.

Hobbes and Wallis's "battle of the books" illuminates the intimate relationship between science and crucial seventeenth-century debates over the limits of sovereign power and the existence of God.

"An outstanding study of mathematics, philosophy, and society in the seventeenth century. By carefully delineating both the intellectual and social contexts of the bitter dispute with Wallis, Jesseph reveals the unexpected interest and significance of Hobbes's ill-fated attempts to solve the classical problems of geometry."
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"Douglas Jesseph brilliantly chronicles and analyzes the seventeenth-century debate between Thomas Hobbes and John Wallis on the foundations of mathematics, a debate that went well beyond mathematical and methodological concerns, spilling into questions of politics, church government, theology, and philosophy. Jesseph gives a detailed introduction to the intellectual context surrounding these issues. Moreover, his emphasis on the controversy is instrumental in providing an accurate image of Hobbes's materialist philosophy of mathematics."
—Roger Ariew, Virginia Polytechnic Institute, coeditor of *Descartes and His Contemporaries: Meditations, Objections, and Replies*

DOUGLAS M. JESSEPH is associate professor of philosophy at North Carolina State University. He is author of *Berkeley's Philosophy of Mathematics*, published by the University of Chicago Press, and is currently editing three volumes of Hobbes's mathematical publications for *The Clarendon Edition of the Works of Thomas Hobbes*.

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ISBN 0-226-39900-1
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